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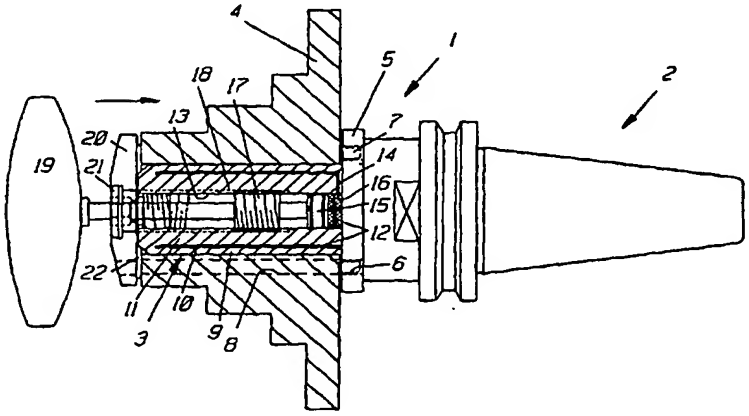

(57) Abstract

A hydraulic precision mandrel for use in rotary machine tools and comprising a transition part (1) and a clamp body (3) which is fixedly connected thereto, onto which clamp body one or more tools can be slided and can be secured, and in which the clamp body (3) is formed as a hydraulic clamp bushing having a radially outwards expandable outer wall (9) and, radially inside said outer wall (9), an all around extending gap (10) which is filled with a hydraulic pressure medium (12), and in which the clamp body (3) is formed with an axial, central bore (13) provided in the clamp body (3), one or more cross channels (14) opening in the pressure medium gap (10), a piston (15) defining a pressure medium chamber (16) which is filled with pressure medium (12) and which is located at or adjacent the inner end of the clamp body bore (13), and a pusher means (17), for instance a threaded pusher piston which is within reach through the free end of the clamp body, for instance by means of a wrench (19) and which is adapted to move the piston inwards or outwards in the mandrel body bore (13) for pressurization and pressure releasing, respectively, of the pressure medium in the all around extending pressure medium gap (10). The mandrel comprises a rubber spring (20, 22) for resiliently pressing and radially straightening up the tool or tools (4) against a radial flange (5) of the transition part.

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HYDRAULIC PRECISION MANDREL

The present invention generally relates to a mandrel which is preferably arranged for being mounted, with one end thereof, in a rotary machine tool, for instance in a lathe machine, a milling machine, a drilling machine etc. The mandrel can, alternatively and as desired, be releasably or fixedly mounted in the machine tool. In case the mandrel is of a releasable type it is mounted for instance by means of a mandrel cone part. The opposite end of the mandrel, for instance the free end thereof, should be formed for keeping one or more working tools or work pieces releasably secured thereon.

Various types of mandrels of said general type are known in the art. Such known mandrels generally are formed so that one or more of the exchangeable tools are secured in the direction of rotation of the mandrel by mechanical means like keys, splines and similar means, or by a heat press joint, and, in the direction for avoiding axial displacement, by means of nuts or screws. Such mechanical locking means do not give a perfect precision, and they may present radial play for the working tool, and it may often be difficult to provide a perfect centering of the mandrel with the tool, what in turn can give rise to unsatisfactory balancing and vibrations in the working tool and the tool machine depending thereon. It may also often be a difficult and time consuming operation to release the joint between the mandrel and the tools, especially in case the tools are mounted by heat press joints.

The present invention is intended to solve the above mentioned problems and disadvantages and to provide a precision mandrel for use in rotary machine tools, and which has, at its free end, a a clamp body (mandrel arbor), which is designed so that one or more tools can be slidingly moved onto said arbor and can be secured thereon without the use of keys, splines and other mechanical locking means, which may be provided on the envelope surface of the clamp body, or without press joints, and in which a prefect centering and a perfect balancing of the tool or tools is obtained.

According to the invention said problem is solved in that the clamp body is formed as a hydraulic clamp bushing having a relatively thin outer wall and, radially inside of said outer wall, an all around extending pressure medium gap which is filled with a hydraulic pressure medium which, when being pressurized, makes said outer wall expand radially outwards thereby centering and clamp connecting the tool or tools on the clamp body.

For providing a safe rotary locking of the tools on the mandrel the tool

or tools, which are mounted closest to a transition part of the mandrel arranged between the two ends of the mandrel, can be formed with a couple of follower pins arranged to engage corresponding follower bores of the transition part.

For security reasons, for instance in case the operator happens to forget to activate the hydraulic system, the mandrel can be formed with a security ring, for instance a clamp ring formed with a rubber spring, which ring can be screw connected to the end of the clamp body, and which security ring foresees that the tool or tools engage the transition part before the hydraulic pressure medium is pressurized. The security ring can be connected to the clamp body by means of a screw which is threaded into the clamp body, or the tool or tools can be formed with through bores for connection screws which can be secured in threaded bores of the transition part. It is, however, important that the tool should not be allowed to be finally locked by means of mechanical forces, but that the tool should be centered and clamp connected by hydraulic means.

For providing a pressurization of the pressure medium gap the clamp body (the expandable arbor) can be formed with a central bore having a pressure piston mounted therein, which defines a pressure chamber which, over one or more cross channels is connected to the pressure medium gap, and in which the pressure medium of said chamber can be actuated by a piston which can be tightened by means of a wrench extending through the security means and through the bore of the clamp body, for instance a hexagon spanner, which directly engages the pressurization piston, and which co-operates with inner threads of the central bore of the clamp body.

Now the invention is to be described more closely with reference to the accompanying drawings, in which figure 1 discloses a hydraulic precision mandrel according to the invention in a partly cut open state before the tool has been mounted. Figure 2 correspondingly shows the hydraulic mandrel after one or more tools have been mounted on the clamp body and while the hydraulic pressure medium of the pressure medium gap is being pressurized.

The hydraulic mandrel shown in the drawings generally comprises a transition part 1 provided between the two ends of the mandrel, a mandrel cone part 2 for engagement in a corresponding conical bore of a rotary tool machine and a mandrel arbor or clamp body 3 for releasably connecting one or more tools 4 and securing same on the clamp body 3. The transition part 1,

the cone 2 and the clamp body 3 provides an integral unity.

The transition part 1 and the mandrel cone 2 are of a type which is known per se and need not be described in detail. The cone is adapted for being introduced in a correspondingly conically formed cavity of a rotary machine tool, for instance a lathe machine, a milling machine, a drilling machine etc.

For making it possible to connect one or more rotary tools 4 on the mandrel the clamp body (expandable arbor) is formed with a smooth cylindrical outer surface. If wanted said outer surface can be formed with different (stepped) diameters for centering and clamp connecting tools/work pieces having different fitting diameters. The tools 4 are slided into contact with a projecting flange 5 of the transition part 1. Said flange 5 can be formed with a pair of bores 6 in which follower pins 7 of the tool located closest to the flange 5 can engage for providing a rotary engagement of the tools. Alternatively the tools can have through bores 8 (see the lower part of figure 2) through which clamp screws can be introduced and can be threaded into the bores 6 of the flange 5.

The clamp body 3 is formed as a hydraulic clamp bushing, and to that end it has a relatively thin, radially outwards expandable outer wall 9 and an all around extending narrow gap 10 facing the radially inner thereof located supporting body 11, which gap 10 is filled with a hydraulic pressure medium 12, which upon pressurization of the pressure medium makes said outer wall 9 expand radially outwards thereby centering, balancing and clamp connecting the tool or tools 4 which have been slided onto the clamp body 3.

For making it possible to pressurize the pressure medium 12 of the gap 10 the clamp body is formed with an axial bore 13 which, at the inner end thereof, has one or more cross channels 14 opening into the pressure medium gap 10. At the inner end of the axial bore 13 of the arbor 3 there is a displaceable piston 15 defining a pressure chamber 16, which is filled with a pressure medium 12. At the axially outer end the piston 15 has a pushing means 17 which co-operates with inner threads 18 of the bore 13. The pusher means 17 has an inner connection bore for a wrench 19, for instance a hexagonal wrench of T-handle type. When the pusher 17 and thereby also the pressure piston 15 is tightened by means of the wrench 19 pressure medium is forced from the pressure medium chamber 16, through the cross channel 14 and into the all around extending pressure medium gap 10 thereby

providing a radial expansion of the outer wall 9 and a centering and clamp connecting of the tools 4 on the clamp body 3. When untightening the pusher means 17 the outer wall 9 regains its non-expanded shape and the tools 4 become released.

For providing an accurate connection of the tools, and for eliminating any type of wobbling thereof it is important that the tools are pressed against the flange 5 of the transition part 1, and to that end the apparatus comprising a pressure ring 20 which can be screwed into contact with the end of the clamp body 3 by means of a tap screw 21 which engages inner threads 18 of the mandrel bore 13, and which with the head thereof forces the pressure ring 20 in the direction towards the transition part 1. The pressure ring 20 preferably can have a rubber spring 22 enclosed therein for providing a resilient forcing of the tools 4 against the flange 5. Both the pressure ring 20 and the screw 21 are formed with axial through bores, so that the wrench 19 can be introduced in the pusher means 17 thereby providing a pressurization and a pressure releasing, respectively, of the hydraulic pressure medium of the pressure medium gap 10.

The mounting of the tools is simply made in that it is firstly foreseen that the pressure medium gap 10 of the clamp body 3 is released from pressure; one or more tools and slided onto the clamp body 3 and into contact with the flange 5 of the transition part 1, and so that the follower pins 7 engage the corresponding bores 6 of said flange 5; the pressure ring 20 is tightened by means of the tap screw 21, so that the tools are resiliently pressed against the flange 5 by the action of the rubber spring 22; a wrench 19 is introduced through the bore of the screw 21 and the pressure ring 20 and into the wrench receiving bore of the pusher means 17, and said pusher means is tightened by a certain force, whereupon the tools are centered and clamp connected by the thin outer wall 9.

The releasing of the tool/tools follows in the opposite order.

As mentioned above the pressure ring can alternatively be screw connected by means of two of more tap screws extending axially therethrough the pressure ring 10 and through the tools, and which can be threaded into the bores 6 of the flange 5.

REFERENCE NUMERALS

	1	transition part	12	pressure medium
	2	mandrel cone	13	axial bore
	3	clamp body	14	cross channel
5	4	tool/tools	15	pressure piston
	5	flange	16	pressure chamber
	6	bore (of the flange)	17	pusher means
	7	follower pin	18	threads
	8	bore (of the tool/tools)	19	wrench with handle
10	9	outer wall	20	pressure ring
	10	gap	21	screw
	11	supporting body	22	rubber spring

CLAIMS

1. Mandrel intended for use in rotary machine tools and comprising a transition part (1) and a clamp body (3) connected thereto, onto which clamp body one or more tools can be slided and on which said tool/tools can be secured, and in which the clamp body (3) is formed as a hydraulic clamp bushing having a thin, smooth outer wall (9) and, radially inside thereof, a gap (10) which is filled with a hydraulic pressure medium (12) which, when pressurized, makes the outer wall (9) expand radially outwards, **characterized** in that the mandrel is formed with means inside the mandrel body (11) for pressurizing the pressure medium (12) in the pressure medium gap (10), which means comprises an axial, central bore (13) in the mandrel body (11), one or more cross channels (14) opening in the pressure medium gap (10) at a place adjacent the end of the mandrel body bore (13), a piston (15) defining a pressure medium chamber (16) which chamber is filled with pressure medium (12) at or adjacent the inner end of the mandrel body bore (13), and a pusher means (17) which is actuatable from outside through the free end of the clamp body, and which is arranged for displacing the piston (15) inwards or outwards in the mandrel body bore (13) for pressurizing and releasing pressure, respectively, of the pressure medium in the all around extending pressure medium gap (10).

2. Mandrel according to claim 1, **characterized** in that the pusher means is a rotatable piston (17) which is threaded and engages inner threads (18) of the mandrel body bore (13) and which is formed with a coupling bore for engagement of a wrench (19) introduced through the mandrel body bore (13) and used for tightening an untightening, respectively, of the piston (15, 17).

3. Mandrel according to claim 1 or 2, **characterized** in that the transition part (1) has a radial flange (5) at the connection end for the clamp body, and in that the mandrel, at the free end of the clamp body (3), has a pressure ring (20) adapted to press and to straighten up the tool or tools (4) against the flange (5) before the tools are clamp connected by pressurization of the pressure medium gap (10) of the clamp body (3).

4. Mandrel according to claim 3, **characterized** in that the pressure ring (20) is secured to the mandrel by means of a central tap screw (21) which is connected to the threaded bore (18) of the clamp body (11) by means of

screw threads.

5. Mandrel according to claim 3, **characterized** in that the pressure ring (20) is secured to the mandrel by means of a pair of screws extending through the tool or tools (4), which screws are threaded into the transition part (1).

6. Mandrel according to claim 3, 4 or 5, **characterized** in that the tool (4), or the tool located closest to the transition part (1) is formed with a pair of follower pins (7) arranged to engage corresponding follower bores (6) of the transition part.

7. Mandrel according to any of claims 3 - 6, **characterized** in that the pressure ring (20) is formed with a rubber ring (22) which is partly embedded in the pressure ring (20) and which acts as a rubber spring when the tool or tools is/are pressed against the flange (5) of the transition part (1).

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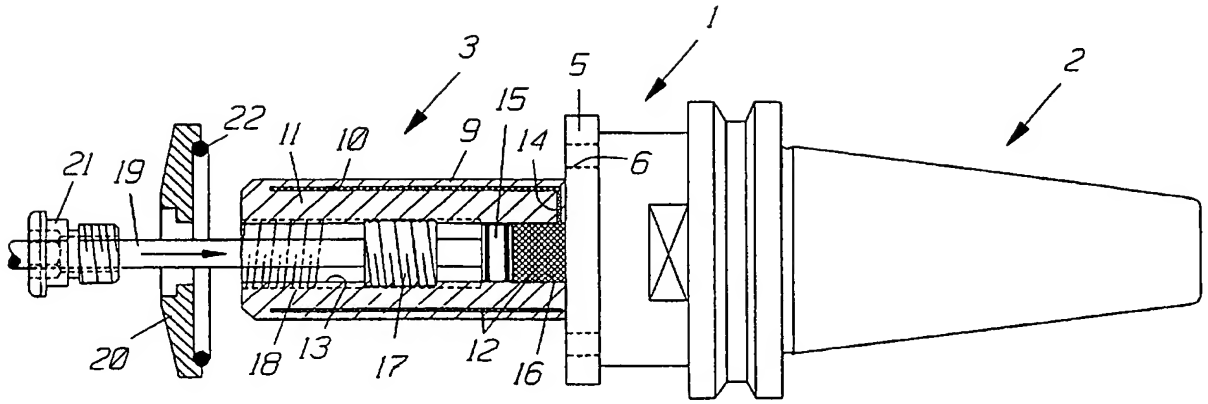
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Fig. 1

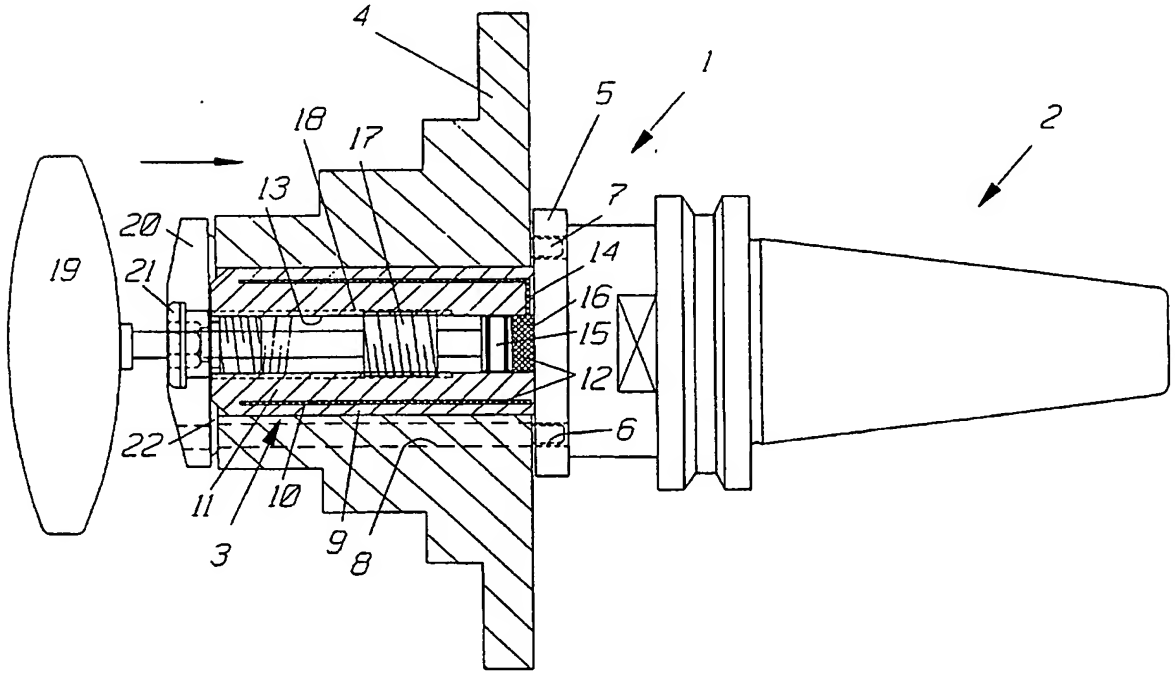
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Fig. 2